

**IN THE CLAIMS**

The following claim set replaces all prior versions, and listings, of claims in the application:

16. (Currently Amended) A method of pre-treating, prior to bleaching with peroxide, cellulose pulp, to improve bleachability of the pulp, using an acid tower, and a tower in a second treatment stage, comprising the steps of substantially sequentially:

- (a) if necessary, adjusting the pH of the pulp to between 2-6 by adding aminic acid, sulfuric acid, hydrochloric acid or another acid which does not contain oxidizing perhydroxyl ions;
- (b) feeding the pulp to the acid tower;
- (c) treating the pulp in the acid tower at substantially the pH, between ~~2-6~~ about 3-4, to which it has been adjusted in step (a), at a pressure of 0-20 bar, at a temperature of ~~75-130°C~~ 80-110°C, and for 20-240 minutes, so that acid treatment decreases the kappa number by ~~4-9~~ at least 2 units;
- (d) transferring the pulp from the acid tower to the tower of the second treatment stage,
- (e) in the second treatment stage tower treating the pulp with a complexing agent at a pH of between 4-9;
- (f) washing, pressing, or both washing and pressing the pulp; and
- (g) bleaching the pulp with hydrogen peroxide using 5 to 20 kg peroxide/adt and 0 – 15 kg oxygen/adt.

17. (Canceled)

18. (Currently Amended) A method as recited in claim ~~47~~ 16 wherein step (e) is practiced using a complexing agent, and at a pH of between about 5-6.

19. (Currently Amended) A method as recited in claim ~~47~~ 16 wherein step (e) is practiced using as an oxidizing chemical chlorine dioxide prior to or in combination with the complexing agent.

20. (Canceled)

21. (Currently Amended) A method as recited in claim ~~20~~ 16 wherein step (g) is practiced by treating with hydrogen peroxide alone in a stage, or by adding hydrogen peroxide to an alkaline stage.

22. (Previously Added) A method as recited in claim 18 wherein prior to step (e), between steps (c) and (e), adding acid to alkali to the pulp to adjust the pH thereof.

24. (Currently Amended) A method ~~as recited in claim 16~~ of pre-treating, prior to bleaching with peroxide, cellulose pulp, to improve bleachability of the pulp, using an acid tower, and a tower in a second treatment stage, comprising the steps of substantially sequentially:

- (a) if necessary, adjusting the pH of the pulp to between 2-6 by adding aminic acid, sulfuric acid, hydrochloric acid or another acid which does not contain oxidizing perhydroxyl ions;
- (b) feeding the pulp to the acid tower;
- (c) treating the pulp in the acid tower at substantially the pH, between 2-6, to which it has been adjusted in step (a), at a pressure of 0-20 bar, at a temperature of 75-130°C, and for 20-240 minutes, so that acid treatment decreases the kappa number by 1-9 units;
- (d) transferring the pulp from the acid tower to the tower of the second treatment stage,
- (e) in the second treatment stage tower treating the pulp with a complexing agent at a pH of between 4-9;

- (f) washing, pressing, or both washing and pressing the pulp; and
- (g) bleaching the pulp with hydrogen peroxide using 5 to 20 kg peroxide/adt and 0 – 15 kg oxygen/adt, wherein

step (f) is practiced by washing the pulp in a fractionating washer so that a first filtrate containing heavy metals is removed from the process, and a second, cleaner, filtrate is recycled for use in another stage of the method.

25. (Currently Amended) A method as recited in claim ~~20~~ 24 wherein step (g) is practiced using two towers which are different in size and connected to each other, the first tower acting as a pretreatment reactor and the second tower as a bleach tower.

26. (Previously Submitted) A method as recited in claim 25 wherein step (g) is further practiced by: mixing peroxide with the pulp; feeding the pulp into the pretreatment reactor and treating the pulp in the pretreatment reactor at a pressure of 3-20 bar and for a reaction time of 10-60 minutes, so that the peroxide reacts with the pulp; separating gas from the pulp; using the pressure in the pretreatment reactor, blowing the pulp to a lower section of the bleach tower so that the pulp flows upwardly in the bleach tower; and removing the pulp from the top of the bleach tower after the pulp reacts with the peroxide in the bleach tower.

27. (Previously Submitted) A method as recited in claim 26 wherein the mixing step is practiced by adding 5-20 kg/adt peroxide, and 0-10 kg/adt oxygen to the pulp.

28. (Previously Submitted) A method as recited in claim 26 wherein step (g) is further practiced by using a peroxide dosage that is from about 5 to just below 10 kg/adt, and using an oxygen dosage of between 5-15 kg/adt.

29. (Previously Submitted) A method as recited in claim 26 wherein during treatment of the pulp in the bleach tower the pressure is between 1.1-5 bar, and the temperature 80-130°C.

30. A method ~~as recited in claim 16 wherein step (g) is practiced~~ of pre-treating, prior to bleaching with peroxide, cellulose pulp, to improve bleachability of the pulp, using an acid tower, and a tower in a second treatment stage, comprising the steps of substantially sequentially:

- (a) if necessary, adjusting the pH of the pulp to between 2-6 by adding aminic acid, sulfuric acid, hydrochloric acid or another acid which does not contain oxidizing perhydroxyl ions;
- (b) feeding the pulp to the acid tower;
- (c) treating the pulp in the acid tower at substantially the pH, between 2-6, to which it has been adjusted in step (a), at a pressure of 0-20 bar, at a temperature of 75-130°C, and for 20-240 minutes, so that acid treatment decreases the kappa number by 1-9 units;
- (d) transferring the pulp from the acid tower to the tower of the second treatment stage;
- (e) in the second treatment stage tower treating the pulp with a complexing agent at a pH of between 4-9;
- (f) washing, pressing, or both washing and pressing the pulp; and
- (g) bleaching the pulp in two stages using peroxide, the first stage in sequence using a peroxide dosage of between 5 to just below 10 kg/adt and with about 5-15 kg/adt oxygen, and the second peroxide stage in sequence having a dosage of 10-20 kg/adt peroxide and an oxygen dosage of 0-10 kg/adt.

31. (Canceled)

32. A method ~~as recited in claim 16 wherein step (g) is practiced by adding of~~ pre-treating, prior to bleaching with peroxide, cellulose pulp, to improve bleachability of the pulp, using an acid tower, and a tower in a second treatment stage, comprising the steps of substantially sequentially:

- (a) if necessary, adjusting the pH of the pulp to between 2-6 by adding aminic acid, sulfuric acid, hydrochloric acid or another acid which does not contain oxidizing perhydroxyl ions;
- (b) feeding the pulp to the acid tower;
- (c) treating the pulp in the acid tower at substantially the pH, between 2-6, to which it has been adjusted in step (a), at a pressure of 0-20 bar, at a temperature of 75-130°C, and for 20-240 minutes, so that acid treatment decreases the kappa number by 1-9 units;
- (d) transferring the pulp from the acid tower to the tower of the second treatment stage,
- (e) in the second treatment stage tower treating the pulp with a complexing agent at a pH of between 4-9;
- (f) washing, pressing, or both washing and pressing the pulp; and
- (g) bleaching the pulp with hydrogen peroxide using between 5 to just below 10 kg/adt peroxide and 5-15 kg/adt oxygen.

33. (Previously Added) A method as recited in claim 19 wherein step (e) is practiced by using 5-30 kg/adt chlorine dioxide calculated as active chlorine.

34. (Currently Amended) A method ~~as recited in claim 16~~ of pre-treating, prior to bleaching with peroxide, cellulose pulp, to improve bleachability of the pulp, using an acid tower, and a tower in a second treatment stage, comprising the steps of substantially sequentially:

- (a) if necessary, adjusting the pH of the pulp to between 2-6 by adding aminic acid, sulfuric acid, hydrochloric acid or another acid which does not contain oxidizing perhydroxyl ions;
- (b) feeding the pulp to the acid tower;
- (c) treating the pulp in the acid tower at substantially the pH, between 2-6, to which it has been adjusted in step (a), at a pressure of 0-20 bar, at a temperature of 75-130°C, and for 20-240 minutes, so that acid treatment decreases the kappa number by 1-9 units;
- (d) transferring the pulp from the acid tower to the tower of the second treatment stage,
- (e) in the second treatment stage tower treating the pulp with a complexing agent at a pH of between 4-9;
- (f) washing, pressing, or both washing and pressing the pulp; and
- (g) bleaching the pulp with hydrogen peroxide using 5 to 20 kg peroxide/adt and 0 – 15 kg oxygen/adt, wherein

steps (a) through (g) are practiced as part of a treatment sequence of the pulp, in which the steps are practiced to bleach the pulp to an ISO brightness of over 80, comprising Cooking - O - AQ - P, ~~Cooking - O - AD - P~~, Cooking O - ADQ - P, ~~Cooking - O - Ap<sub>a</sub> - P~~, or Cooking - O - AP<sub>a</sub>Q - P.

35. (Currently Amended) A method ~~as recited in claim 16~~ of pre-treating, prior to bleaching with peroxide, cellulose pulp, to improve bleachability of the pulp, using an acid tower, and a tower in a second treatment stage, comprising the steps of substantially sequentially:

- (a) if necessary, adjusting the pH of the pulp to between 2-6 by adding aminic acid, sulfuric acid, hydrochloric acid or another acid which does not contain oxidizing perhydroxyl ions;

- (b) feeding the pulp to the acid tower;
  - (c) treating the pulp in the acid tower at substantially the pH, between 2-6, to which it has been adjusted in step (a), at a pressure of 0-20 bar, at a temperature of 75-130°C, and for 20-240 minutes, so that acid treatment decreases the kappa number by 1-9 units;
  - (d) transferring the pulp from the acid tower to the tower of the second treatment stage,
  - (e) in the second treatment stage tower treating the pulp with a complexing agent at a pH of between 4-9;
  - (f) washing, pressing, or both washing and pressing the pulp; and
  - (g) bleaching the pulp with hydrogen peroxide using 5 to 20 kg peroxide/adt and 0 – 15 kg oxygen/adt, wherein
- steps (a) through (g) are practiced to produce pulp at an ISO brightness of over 88, and is a part of the treatment sequence of Cooking - O - AQ - P<sub>a</sub>Q - P.

36. (Previously Added) A method of pre-treating, prior to bleaching with peroxide, cellulose pulp, to improve bleachability of the pulp, using an acid tower, and a tower in a second treatment stage, comprising the steps of substantially sequentially:

- (a) if necessary, adjusting the pH of the pulp to between 2-6 by adding aminic acid, sulfuric acid, hydrochloric acid or another acid which does not contain oxidizing perhydroxyl ions;
- (b) feeding the pulp to the acid tower;
- (c) treating the pulp in the acid tower at substantially the pH, between 2-6, to which it has been adjusted in step (a), at a pressure of 0-20 bar, at a temperature of 75-130°C, and for 20-240 minutes, so that acid treatment decreases the kappa number by 1-9 units;

- (d) transferring the pulp from the acid tower to the tower of the second treatment stage,
- (e) in the second treatment stage tower treating the pulp with chlorine dioxide and adding chemicals to the pulp to adjust the metal profile of the pulp prior to, or in combination with, the chlorine dioxide treatment;
- (f) washing, pressing, or both washing and pressing the pulp; and
- (g) bleaching the pulp using hydrogen peroxide.

37. (Previously Added) A method as recited in claim 36 wherein step (c) is practiced at a pH between about 3 - 4, at a temperature of 80-110°C, for a time of 30-180 minutes, and so that acid treatment decreases the kappa number of the pulp by at least 2 units.

38. (Previously Added) A method as recited in claim 37 wherein step (e) is practiced using a complexing agent at a pH of between about 4 – 9.

39. (Previously Added) A method as recited in claim 36 wherein step (g) is practiced by treating with hydrogen peroxide alone in a stage, or by adding hydrogen peroxide to an alkaline stage.

40. (Previously Added) A method as recited in claim 38 wherein prior to step (e), between steps (c) and (e), adding acid or alkali to the pulp to adjust the pH thereof.

41. (Previously Added) A method as recited in claim 36 wherein step (f) is practiced by washing the pulp in a fractionating washer so that a first filtrate containing heavy metals is removed from the process, and a second, cleaner, filtrate is recycled for use in another stage of the method.



42. (Previously Added) A method as recited in claim 36 wherein step (g) is practiced using two towers which are different in size and connected to each other, the first tower acting as a pretreatment reactor and the second tower as a bleach tower.

43. (Previously Added) A method as recited in claim 42 wherein step (g) is further practiced by: mixing peroxide with the pulp; feeding the pulp into the pretreatment reactor and treating the pulp in the pretreatment reactor at a pressure of 3-20 bar and for a reaction time of 10-60 minutes, so that the peroxide reacts with the pulp; separating gas from the pulp; using the pressure in the pretreatment reactor, blowing the pulp to a lower section of the bleach tower so that the pulp flows upwardly in the bleach tower; and removing the pulp from the top of the bleach tower after the pulp reacts with the peroxide in the bleach tower.

44. (Previously Added) A method as recited in claim 36 wherein step (g) is practiced in two stages using peroxide, the first stage in sequence using a peroxide dosage of between 5 to just below 10 kg/adt and with about 5-15 kg/adt oxygen, and the second peroxide stage in sequence having a dosage of 10-20 kg/adt peroxide and an oxygen dosage of 0-10 kg/adt.

45. (Previously Added) A method as recited in claim 36 wherein step (e) is practiced by using 5-30 kg/adt chlorine dioxide calculated as active chlorine.

46. (Previously Added) A method as recited in claim 36 wherein steps (a) through (g) are practiced as part of a treatment sequence of the pulp, in which the steps are practiced to bleach the pulp to an ISO brightness of over 80, comprising Cooking - 0 - AD - P, or Cooking 0 - ADQ - P.